Installation Instructions

for

Model No. SB1B-14
Linear Standby Regulator

With Over-Voltage Protection

B & C Specialty Products
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SB1B-14_Install, Rev. A (12/12/14)

INTRODUCTION

This kit is applicable to any aircraft requiring external control and regulation of a B-type, wound-field Standby Alternator in a 14-volt one-bus, one-battery system.

DESCRIPTION OF INSTALLATION

(1) Remove engine cowl and disconnect aircraft battery.
(2) Remove existing regulator (if applicable).
(3) Install new Standby Controller (Regulator).
(4) Install 2A and 5A circuit breakers, standby alternator master switch, and incandescent warning light on instrument panel.
(5) Wire the SB1B-14 Controller (Regulator), circuit breakers, alternator master switch, incandescent warning light, and Hall-effect current sensor (optional).
(6) Reconnect battery and replace engine cowl.
(7) Update ship's weight and balance, pilot operating handbook and maintenance records.

PARTS LIST

The following parts are supplied with the SB1B-14:

Qty.	Part No.	Description
1	SB1B-14	Standby Alternator Controller (Regulator)
8	S814R6	Terminal, Ring, 18-22AWG
1	S888-1-4	Warning Lamp, Incandescent, Yellow, 14v

The following parts are needed but **not** supplied with this kit:

Qty.	Part No.	Description
1	BC410-H (or equal)	Alternator
1	CB2 (or equal)*	Circuit Breaker, 2A
1	CB5 (or equal)*	Circuit Breaker, 5A
1	S700-2-3 (or equal)*	Switch, Toggle
AR	M22759/16-18-9*	Wire, 18 AWG, White, Tefzel
AR	M22759/16-22-9*	Wire, 22 AWG, White, Tefzel
4	AN3-3A*	Bolt
4	AN960-10L*	Flat washer
4	MS21042-3*	Locking nut

Items noted with an * above items are available as part of a basic installation kit (P/N: LR_INSTALL). An advanced installation kit (P/N: SBK-14) is also available to provide enhanced functionality. Please contact B&C Specialty Products, www.BandC.biz, phone: 316-283-8000, for more information.

CHANGE IN WEIGHT AND BALANCE

Installation of this item will impact aircraft weight by a nominal 0.6 pounds. Variations in airframe station references for eligible aircraft prevent the inclusion of pre-calculated weight and balance data.

INSTALLATION INSTRUCTIONS

Preparation

Step 1. Refer to applicable service manual instructions; remove and retain engine cowl. Disconnect ship's battery, Negative (-) terminal first.

Step 2. Refer to applicable service manual instruction; remove existing regulator.

Step 3. Select a suitable location to mount the SB1B-14. Mounting on the pilot's side of the firewall, or inside the cabin near the panel, is preferred (linear controllers are electrically "quiet," and create no noise when properly installed).

> **NOTE**
> Take care to choose a mounting location that will protect the SB1B-14 from heat, vibration, and water.

Step 4. Select a suitable location to mount the incandescent warning light (supplied) or "STBY ALT" annunciator (optional) in your instrument panel. The light should be positioned within the pilots' peripheral vision — generally, a 45-degree angle in front of the pilot. A panel location away from direct sunlight is preferred.

Step 5. Select a suitable panel location to mount the 2A and 5A circuit breakers. A panel location within the pilot's field of vision and reach is recommended.

Step 6. Select a suitable panel location to mount the standby alternator field switch. A panel location immediately adjacent to the ship's battery master is recommended, if practicable.

Regulator Installation

Step 7. Mount the SB1B-14 to the firewall or selected location, with the terminal strip oriented down (preferred). On a metal firewall, AN3-3A bolts, AN960-10L flat washers, and MS21042-3 locking nuts, will be adequate to secure the regulator.

Step 8. Wire the SB1B-14 power and control circuits using M22759/16 Tefzel wire and the supplied S814R6 ring terminals, according to the wiring diagram on page 8.

> **NOTE**
> The SB1B-14 senses bus voltage through terminal #3. If the warning light is not desired, terminal #5 may be left unconnected; however terminal #3 ***must still be connected*** to the bus through a fuse or circuit breaker. If terminal #3 is not connected to power, the SB1B ***will not work***. Do not connect or "jumper" terminal #3 to terminal #6.

Step 9. Wire the SB1B-14 to ground using M22759/16 Tefzel wire and the supplied S814R6 ring terminals, according to the wiring diagram on page 8. Be certain to establish ground connections to both terminal #7 and the threaded ground stud below the terminal strip.

NOTE

This step is important for all airframes, and ***crucial*** for composite aircraft. The SB1B obtains a redundant connection to ground through the threaded stud. A jumper between terminal #7 and the ground stud will not provide this. Ground connections must be totally independent and not rely on common fasteners. Select 18AWG wire (or larger) and ring terminals for these connections.

Step 10. Wire the 2A and 5A circuit breakers and standby alternator field switch using M22759/16 Tefzel wire, according to the wiring diagram on page 8.

NOTE

If panel space is limited, a 2A in-line fuse may be substituted for the 2A circuit breaker associated with terminal #5. The 5A circuit breaker associated with terminal #6 MUST be used. Connecting terminal #6 directly to the bus or using "solid-state breakers" (PTC thermistors) will damage the regulator if there is an over-voltage condition.

Step 11. Standard installation: wire the incandescent warning light using M22759/16 Tefzel wire, according to the wiring diagram on page 8. Place heatshrink (supplied) over each wire for the warning light base, solder the wires onto the base terminals, and shrink the heatshrink over the connection. Proceed to Step 12.

Optional installation (with SBK-14): wire the "STBY ALT" annunciator assembly and the Hall-effect current sensor, according to the wiring diagram on page 8. The current sensor may be secured to a location on the engine-side of the firewall near the Standby alternator. Proceed to Step 12.

Step 12. Connect ship's battery, Negative (-) terminal last, and replace engine cowl.

Step 13. Test system function, as follows —

Standard installation: Start the engine according to normal procedure. With the engine running and the battery master switch ON, turn the primary alternator field switch and standby alternator field switch ON. Reduce system electrical loads to approximately 10-15 amps. Set engine to a minimum of 2100 RPM. Turn primary alternator field switch OFF; the standby alternator incandescent warning light should illuminate. Turn the primary alternator master switch ON again. Check to see that the warning light extinguishes. Verify that the primary alternator is carrying the load by referencing the load meter, voltmeter, or ammeter (as applicable). Return the engine to idle RPM. Shut down engine according to normal procedure. Proceed to Step 14.

Optional installation (with SBK-14): Start the engine according to normal procedure. With the engine running and the battery master switch ON, turn the primary alternator field switch and standby alternator field switch ON. Reduce system electrical loads to approximately 10-15 amps. Set engine to a minimum of 2100 RPM. Turn primary alternator field switch OFF; the "STBY ALT ON" annunciator should illuminate. Increase system load to

approximately 20 to 25 amps. The "STBY ALT ON" annunciator should begin to flash. Reduce RPM and system load. The "STBY ALT ON" annunciator should return to steady illumination. Turn the primary alternator master switch ON again. Check to see that the "STBY ALT ON" annunciator extinguishes. Verify that the primary alternator is carrying the load by referencing the load meter, voltmeter, or ammeter (as applicable). Return the engine to idle RPM. Shut down engine according to normal procedure. Proceed to Step 14.

Step 14. Update ship's weight and balance, pilot operating handbook and maintenance records.

OPERATION OF THE SB1B-14

The SB1B-14 regulator is designed to control a standby alternator in a one-bus, one-battery electrical system. The standby alternator's output is connected in parallel with the primary alternator's output. Since the SB1B-14 is on the same bus and senses the same voltage as the primary regulator, both the primary alternator and standby alternator field switches should be ON in normal operation. If the bus voltage falls below 13.0 volts for any reason, such as a primary alternator or primary regulator failure, the SB1B-14 will energize the standby alternator, and cause the standby alternator warning light (or optional annunciator) to illuminate.

Charging voltage for the SB1B-14 has been pre-set at 13.0 volts. This voltage does not normally need to be changed; however if adjustment is required, simply remove the 3/4" round plug from the side of the SB1B-14 and use a small screwdriver to turn the small adjustment screw (clockwise to increase voltage, counterclockwise to decrease voltage; approximately 1/2 turn per .16 volts). Use a digital voltmeter at the battery for this measurement.

OVER-VOLTAGE PROTECTION - should the standby alternator output voltage exceed 16 volts, the 5A standby alternator field circuit breaker will open causing the alternator to be shut down. As soon as the current drops to zero, the protection circuit is reset and ready to operate again. A few minutes should be allowed before the circuit breaker is closed to allow the circuit breaker time to cool. Should it trip a second time, assume that further investigation and/or maintenance is required.

INSTALLATION TIPS

1. Avoid deviating from the installation instructions and wiring diagram. The SB1B-14 has been designed to integrate into your aircraft electrical system in a very specific way, with separate bus connections for "sense" and "control". Similarly, the SB1B-14 also requires other associated components, such as circuit breakers and an alternator field switch, which meet certain specifications. These connections and associated components are vital to proper system function.

2. Use time-proven components in your installation. Our technical staff has found that a reliable installation is often made or broken by the associated parts used to install the SB1B-14. Here are several specific choices that can help you avoid trouble:

    - Select a "toggle-type" rather than a "rocker-type" switch for the alternator field switch. Our tear-down analysis of the internals of each type has shown that the mechanical properties and basic materials used in a simple toggle switch will provide superior service over time. Avoid "split-rocker" switches in particular (a common source of reliability woes as they accumulate time in service).

    - Use KLIXON or Mechanical Products circuit breakers, frequently used in general

aviation. These well-constructed, single-purpose devices are reasonably economical, and will serve you well over time. Avoid combination "switch-circuit breakers" (another common source of reliability issues).

- Use nylon pre-insulated ring terminals (supplied), and crimp these with the correct tool. Route wiring along existing harnesses, where they exist, and secure with nylon wire ties. Insure that all wiring is tied away from chafe points and clear of all flight control mechanisms throughout the entire range of control movements. Use a 5-lb pull test to check crimped connections; verify the terminal is crimped on the wire, not the insulation.

- Avoid substituting an LED indicator light for the supplied incandescent warning light. The SB1B-14 is designed to drive an incandescent light only; an LED will not provide satisfactory results (viz. it will remain constantly illuminated, regardless of whether there is an actual over-voltage or low-voltage condition).

- Insure the integrity of your alternator field connector and associated wiring. The SB1B-14 connects to the alternator by means of a single wire; an intermittent connection at the alternator will result in erratic (and unstable) operation.

TROUBLESHOOTING GUIDE

Refer to the wiring diagram found on page 8 and use a high impedance (preferably digital) volt/ohmmeter (DVM) to make the following checks. Please note that the engine should not be running, the mags should be off, and there should be no auxiliary power applied to the aircraft electrical system:

1. Turn all switches OFF. Use the lowest resistance scale on the DVM. Check resistance between the battery negative (-) terminal and both pin 7 of the regulator and the engine case. Measurements over 0.5 Ohm to either would be cause for investigation. In this case, check the engine ground strap, battery ground strap, and regulator ground wire for loose or contaminated connections, broken conductors or bad crimp joints. If these measurements are less than 0.5 Ohm, any of these three points may be used as reference (-) for the following measurements.

   Resistance from battery to pin 7:_____Ohms; from battery to engine case:_____ Ohms

2. Turn ON the battery master and alternator field switches. Measure the voltage on the battery bus and on pin 3 of the regulator. The voltages should be equal within 0.2 volts. A difference of greater than 0.2 volts may be caused by using a breaker as the source for pin 3 that supplies another device of considerable load. Change to a lightly loaded breaker or a breaker dedicated to pin 3 and the low voltage lamp. It is recommended that pin 3 NOT be jumpered to pin 6. If pin 3 has no voltage, the regulator will operate but low voltage warning and over-voltage protection will be lost.

   Bus voltage:_____ volts Pin 3 voltage:_____volts

3. Measure the voltage on pin 6 of the regulator. It should be within 0.5 volts of the bus voltage. A difference of greater than 0.5 volts may be caused by poor contacts in the field breaker or field switch, or poor crimp joints/loose screw terminals in the wiring between the bus and pin 6. Absence of voltage on pin 6 will prevent the regulator from operating.

   Pin 6 voltage:_____volts

4. Check the voltage on pin 4 of the regulator. The voltage should be approximately 1.2 volts less than the voltage on pin 6. A difference significantly less than 1.2 volts between pins 4 and 6 may indicate an open field circuit from pin 4 through the alternator to ground (-). Voltage differences of several volts could indicate a bad regulator. An ideal pin 4 voltage would be approximately 10.9 to 11.4 volts on a 12.6 volt bus.

   Pin 4 voltage:_____volts

5. Move to the engine compartment. Without disconnecting the field connector, measure the field voltage on the alternator. Use a thin probe or small gage wire wrapped around the probe to reach through the connector body and measure the voltage on the male blade coming out of the alternator. It should measure within 0.5 volts of the measurement on pin 4 of the regulator. A lack of voltage may indicate an open circuit between pin 4 of the regulator and the field terminal. If an open field circuit is suspected, the switches may be turned OFF, the alternator field connector removed, and a resistance measurement made between the connector and pin 4 of the regulator. Look for near 0 Ohms. Typically the field resistance of the alternator will be between 3 and 10 Ohms from the male field terminal blade to alternator case.

   Field terminal voltage:_____volts Alternator field resistance:_____Ohms

6. With the switches ON, check the voltage between the alternator output post (or "B"-lead) and ground. It should be battery voltage. If not, check the wiring between the alternator "B"-lead and the battery positive (+) terminal. Look for loose or contaminated connections, broken wires, or an open breaker or fuse.

   Alternator "B"-lead voltage:_____volts

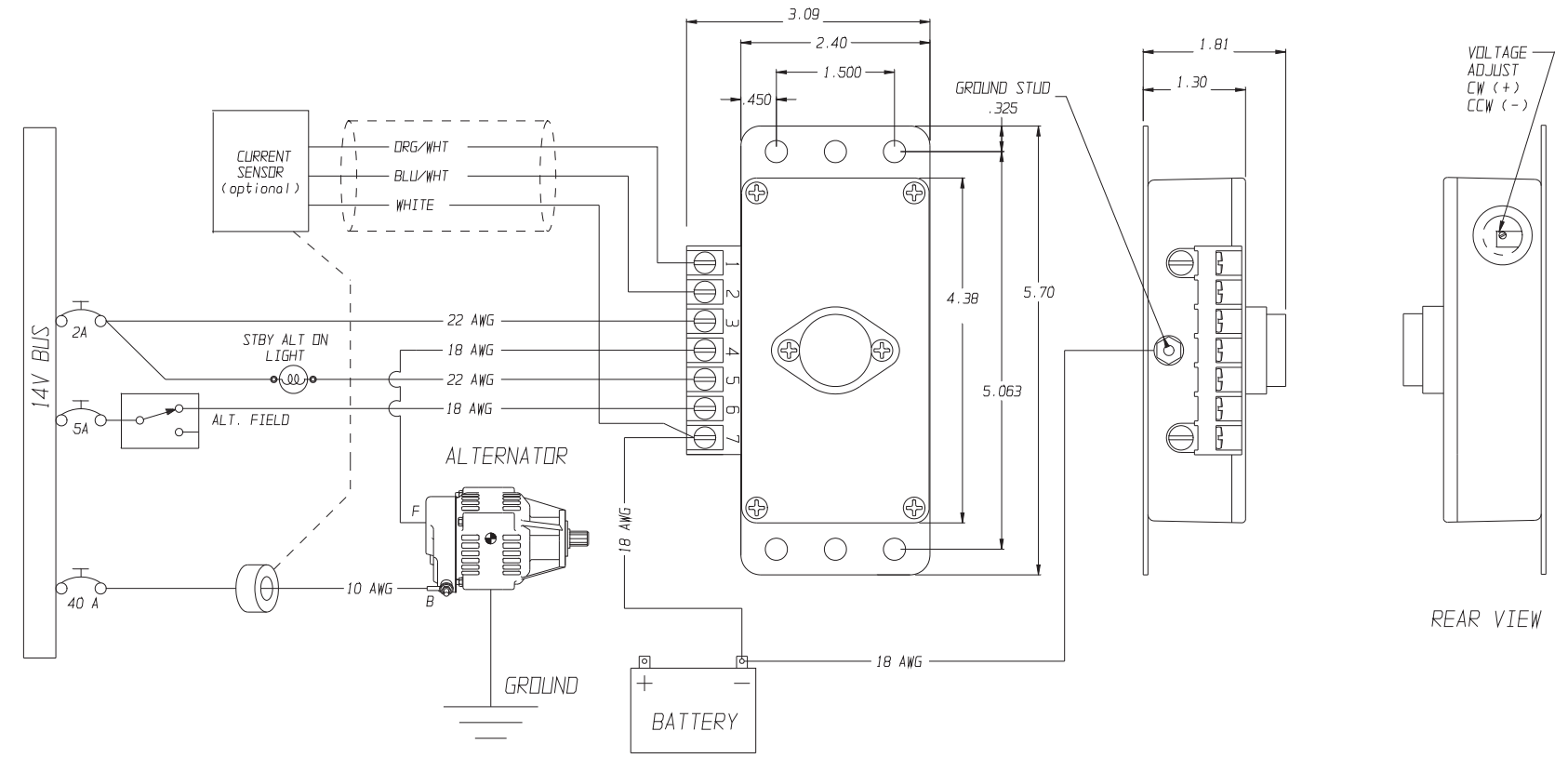
7. If all of the voltages in the first 6 steps are close to the value specified, the charging system should be operative. If not, check for a broken or loose alternator belt; or if the alternator is spline driven, check that the shear coupling has not sheared. In certain installations, it is possible that engine speed will have to be near run-up RPM or more for the system to provide useable output.

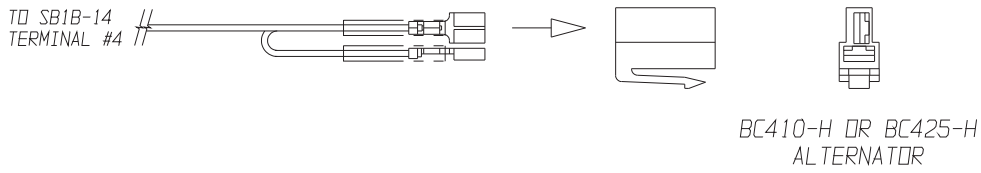
Intermittent problems are the hardest to find. In composite aircraft a common root cause is poor system grounds; metal aircraft can exhibit this defect, also, if proper system grounding is not a priority.

Noise problems can also be challenging. To manage system noise problems, consider the following:

- A unitized grounding system helps prevent noise problems by preventing voltage differences between different ground points.
- The battery acts as a noise filter in the system. Poor connections to the battery, or a battery in the initial stages of failing, can add to or even cause noise problems.
- Shielding of low level audio leads (especially microphone leads or headset leads) is a necessity. Sometimes the shields in the cables can separate from repeated flexing; so a check of shield continuity with an ohmmeter may prove illuminating.
- Wire routing is important. Separate noise-carrying conductors (like "P"-leads) from other wiring. Avoid running noisy wiring parallel to other wiring in the same bundle.

Wiring Diagram for SB1B-14 Voltage Regulator





BC410-H OR BC425-H
ALTERNATOR

THIS PART IS NOT STC'd AND IS SOLD FOR AMATEUR BUILT AIRCRAFT ONLY.

EXPLANATION OF TERMINALS 1 THRU 7

1. SENSOR +10 VOLTS
2. SENSOR ANALOG
3. BUS VOLTAGE SENSE
4. FIELD
5. LOW VOLTAGE WARNING LIGHT
6. BUS SUPPLY
7. GROUND

B&C SPECIALTY PRODUCTS 12/14